In Situ Geoacoustic Measurement of Surficial Seafloor Variability

Barbara J. Kraft and Larry A. Mayer
Center for Coastal and Ocean Mapping
NOAA/UNH Joint Hydrographic Center
University of New Hampshire
Durham, NH USA

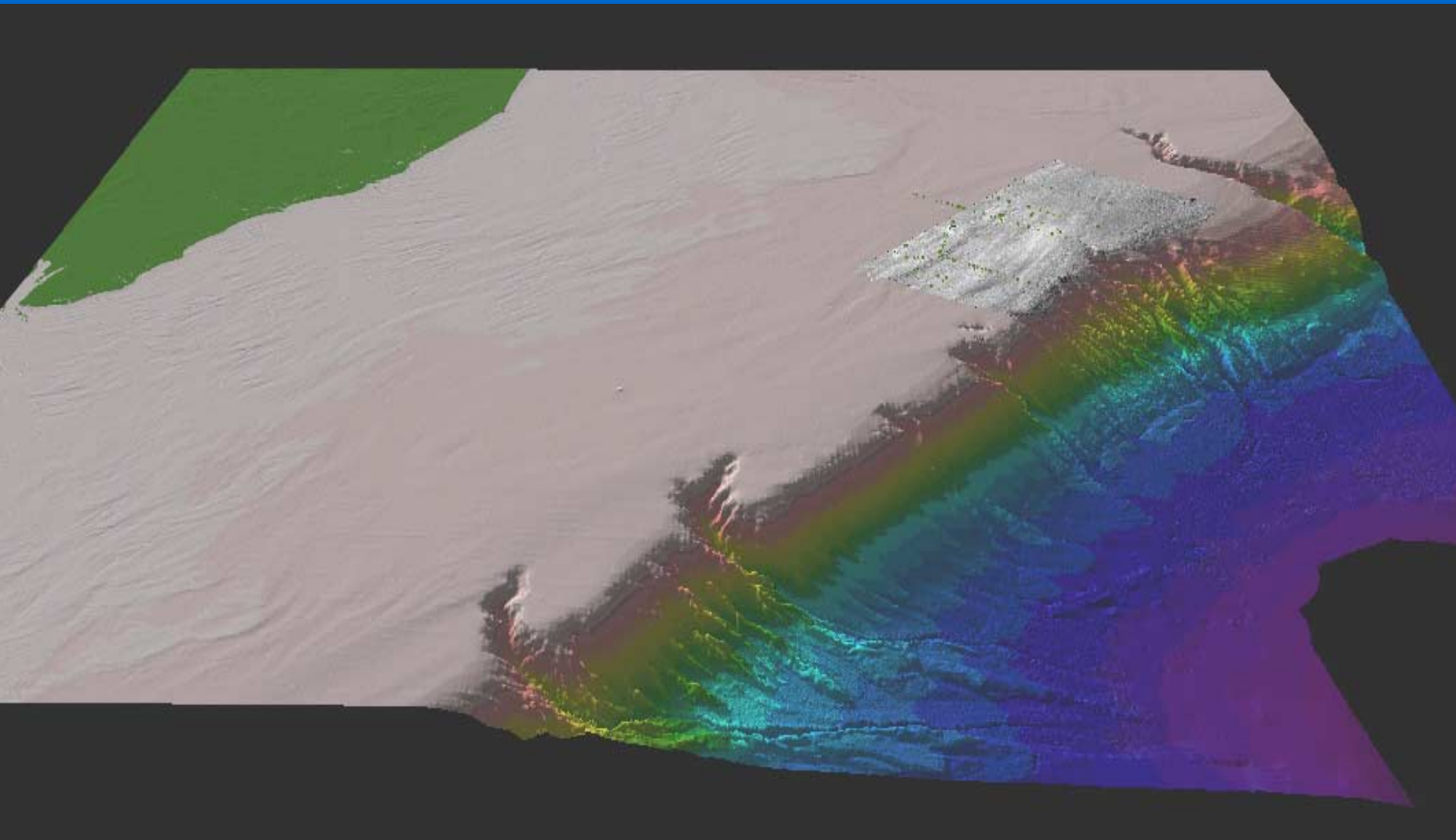
John A. Goff
University of Texas Institute of Geophysics
Austin, TX USA

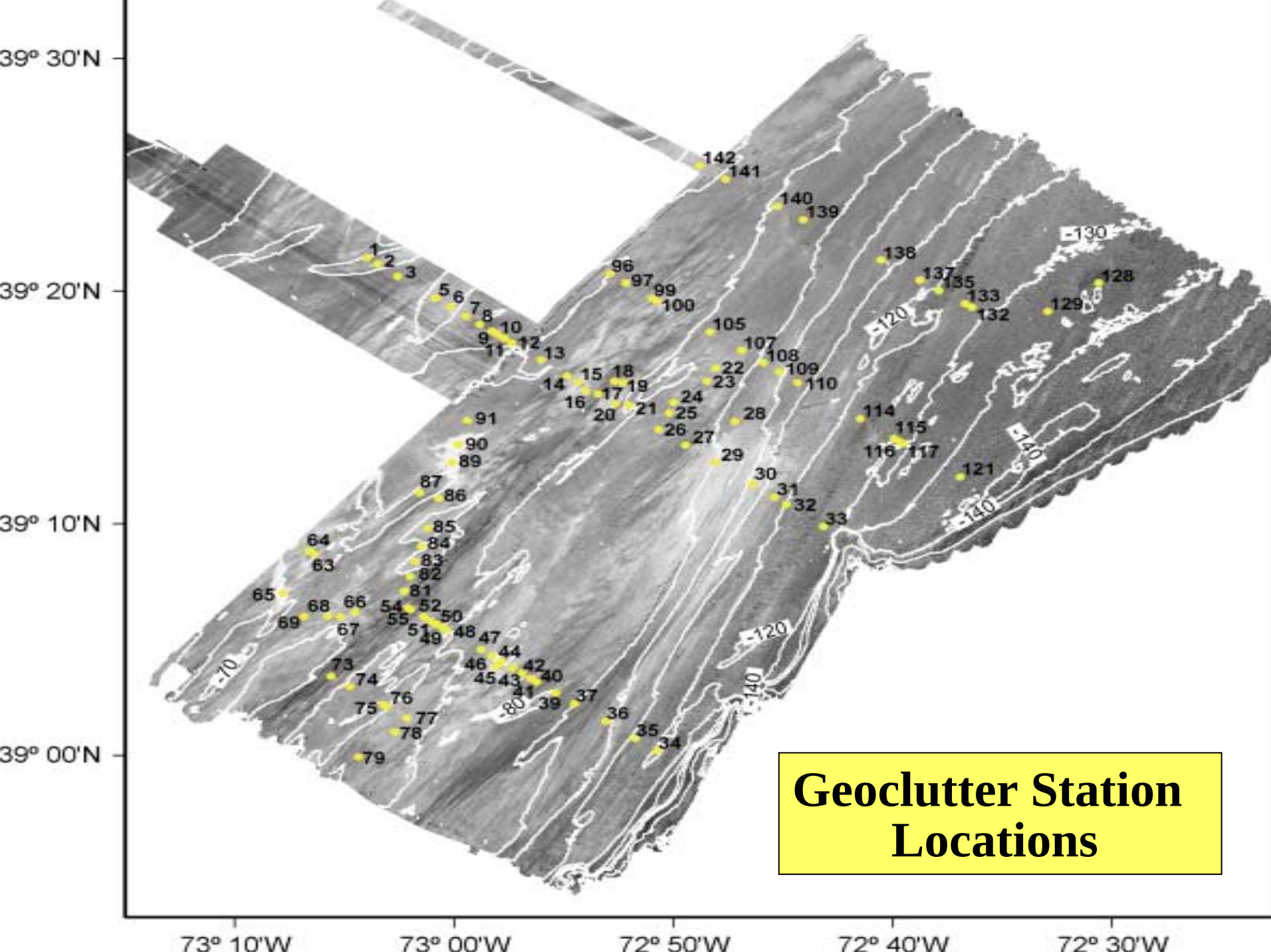
Peter G. Simpkin
IKB Technologies
Bedford, NS, Canada

Geoacoustic Measurements

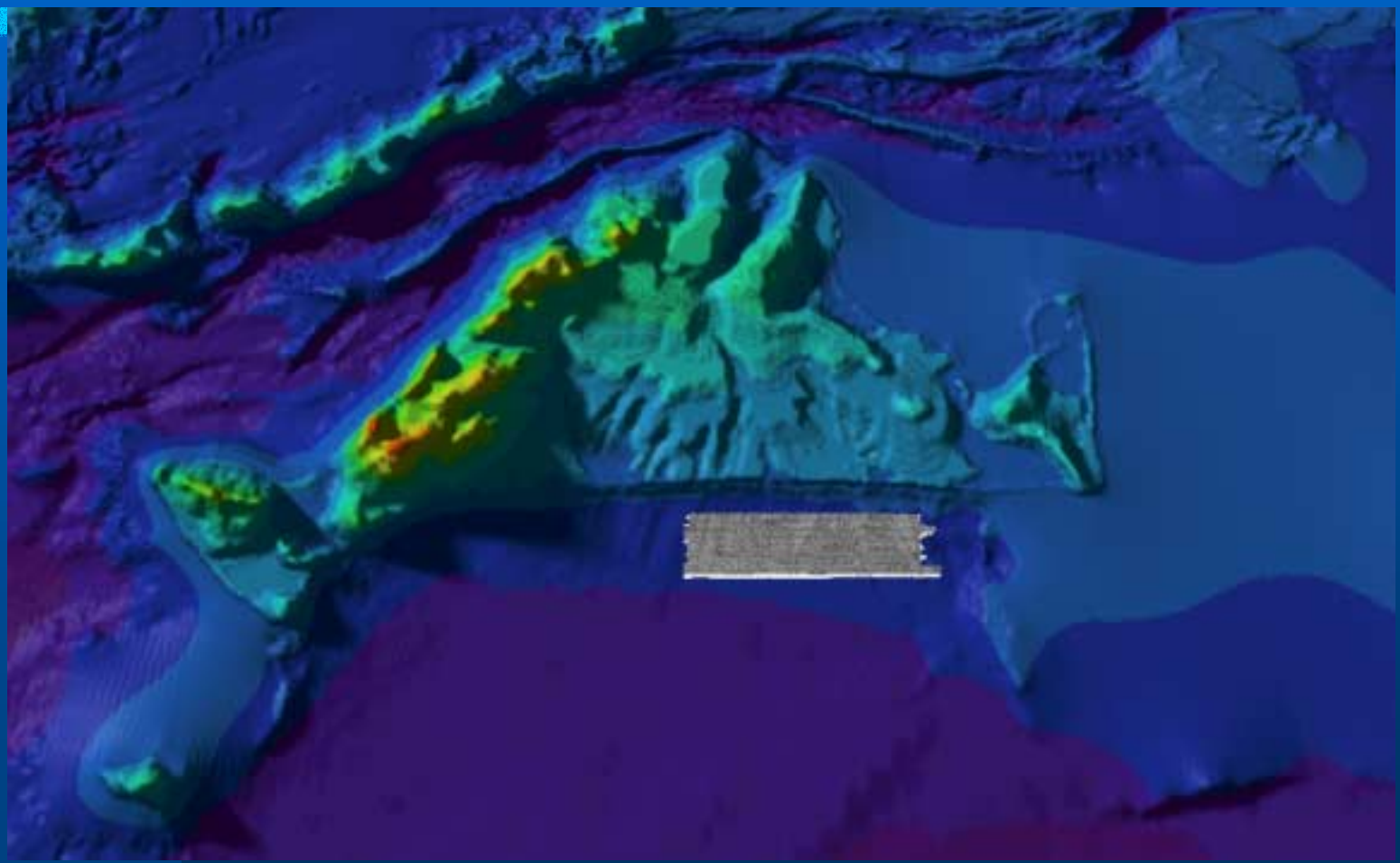
	New Jersey Shelf (ONR Geoclutter Program)	Martha's Vineyard Coastal Observatory (ONR Mine Burial Program)
Type of Measurements Measurements (Surficial)	*In-situ* sound speed, attenuation attenuation (f = 65 kHz) and seafloor imagery	*In-situ* sound speed, attenuation (f = 65 and 100 kHz), resistivity (porosity) and seafloor imagery
Total Number of Measurements	58,200 (96 stations) 5 acoustic paths per station 60 'time-of-flight' measurements per path	61,200 (102 stations) 5 acoustic paths per station 60 60 'time-of-flight' measurements per path

ONR Geoclutter Field Area

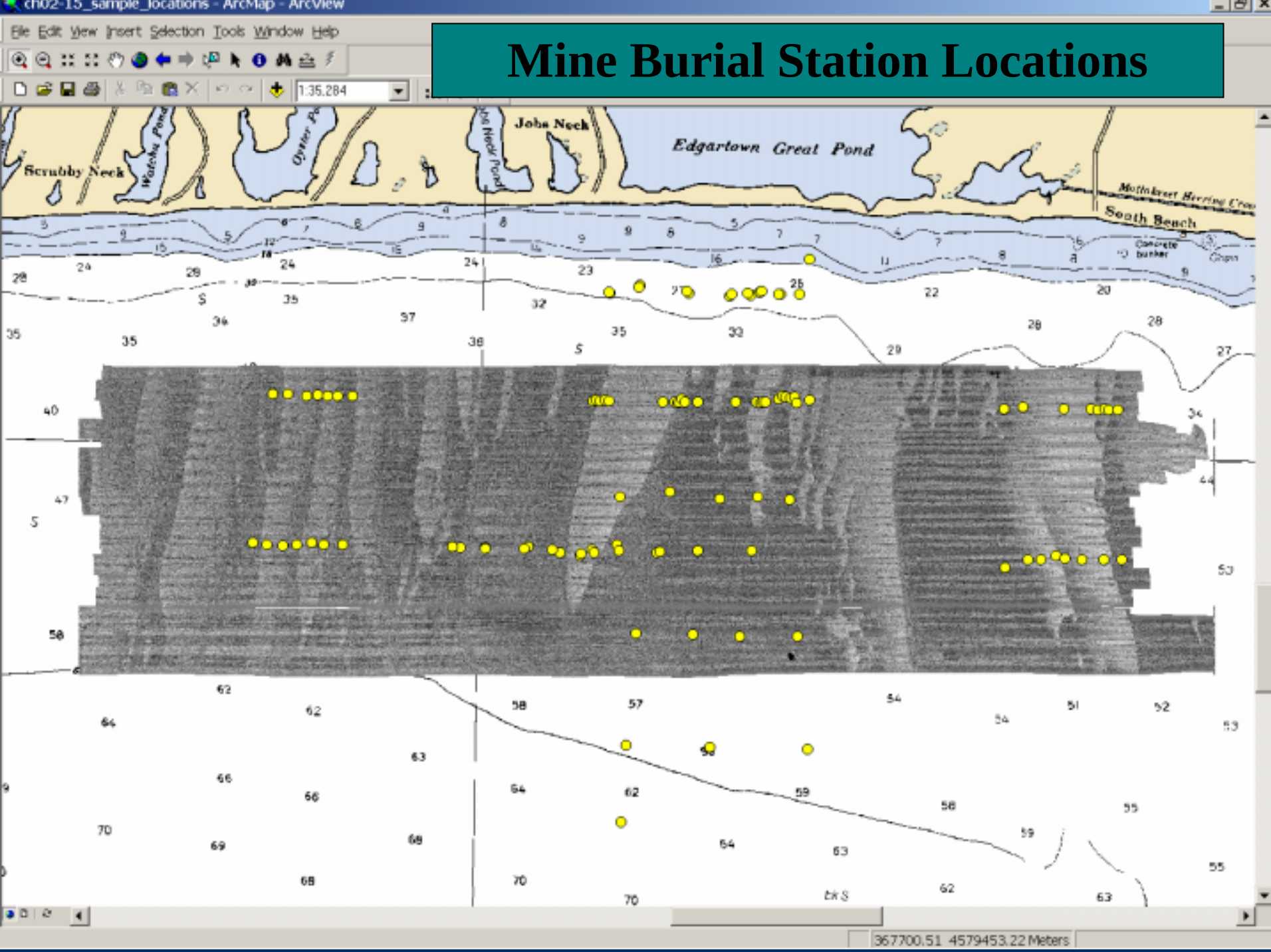



39° 30'N
39° 20'N
39° 10'N
39° 00'N
73° 10'W
73° 00'W
72° 50'W
72° 40'W
72° 30'W
Geoclutter Station Locations

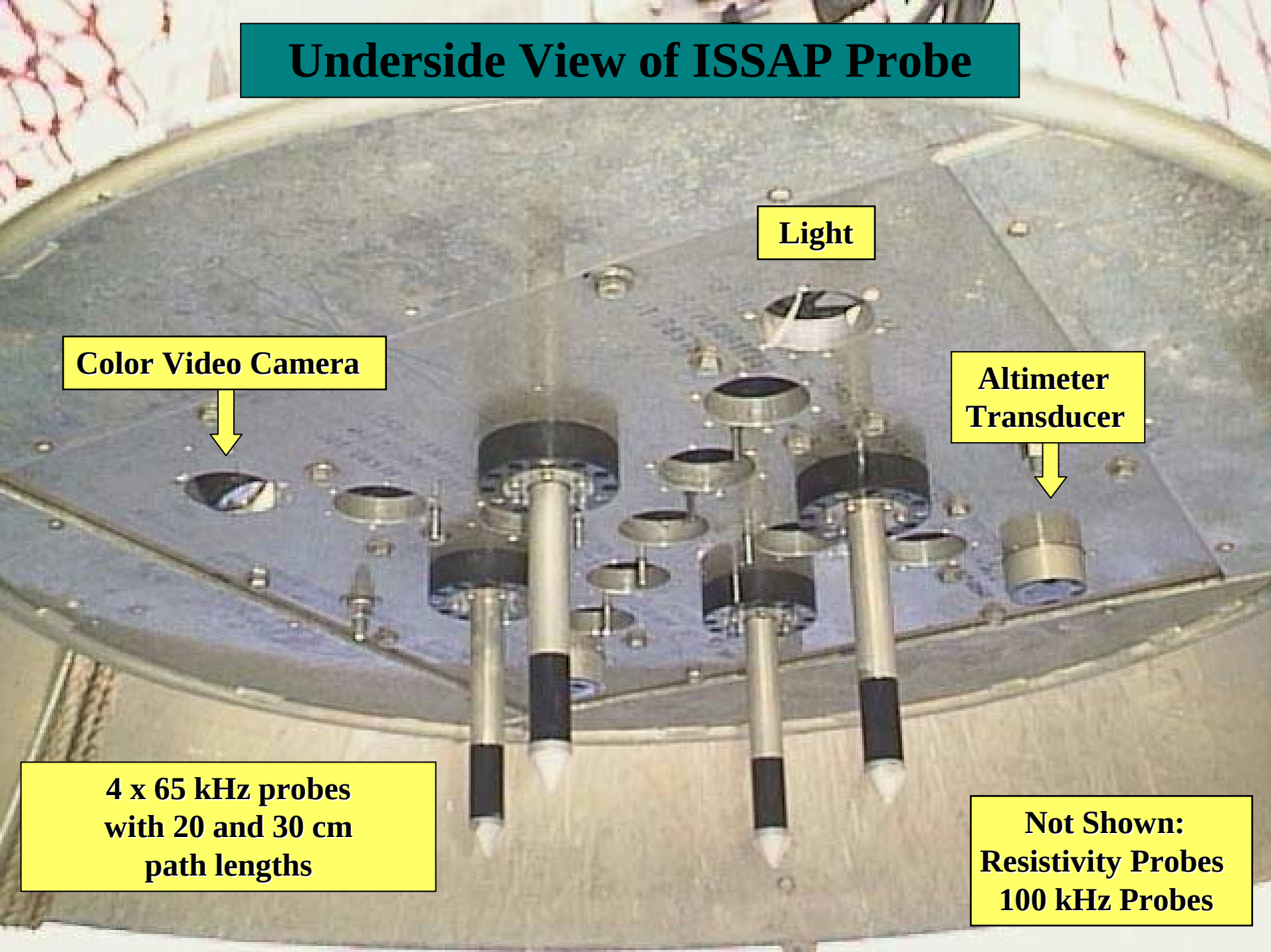
ONR Mine Burial Field Area



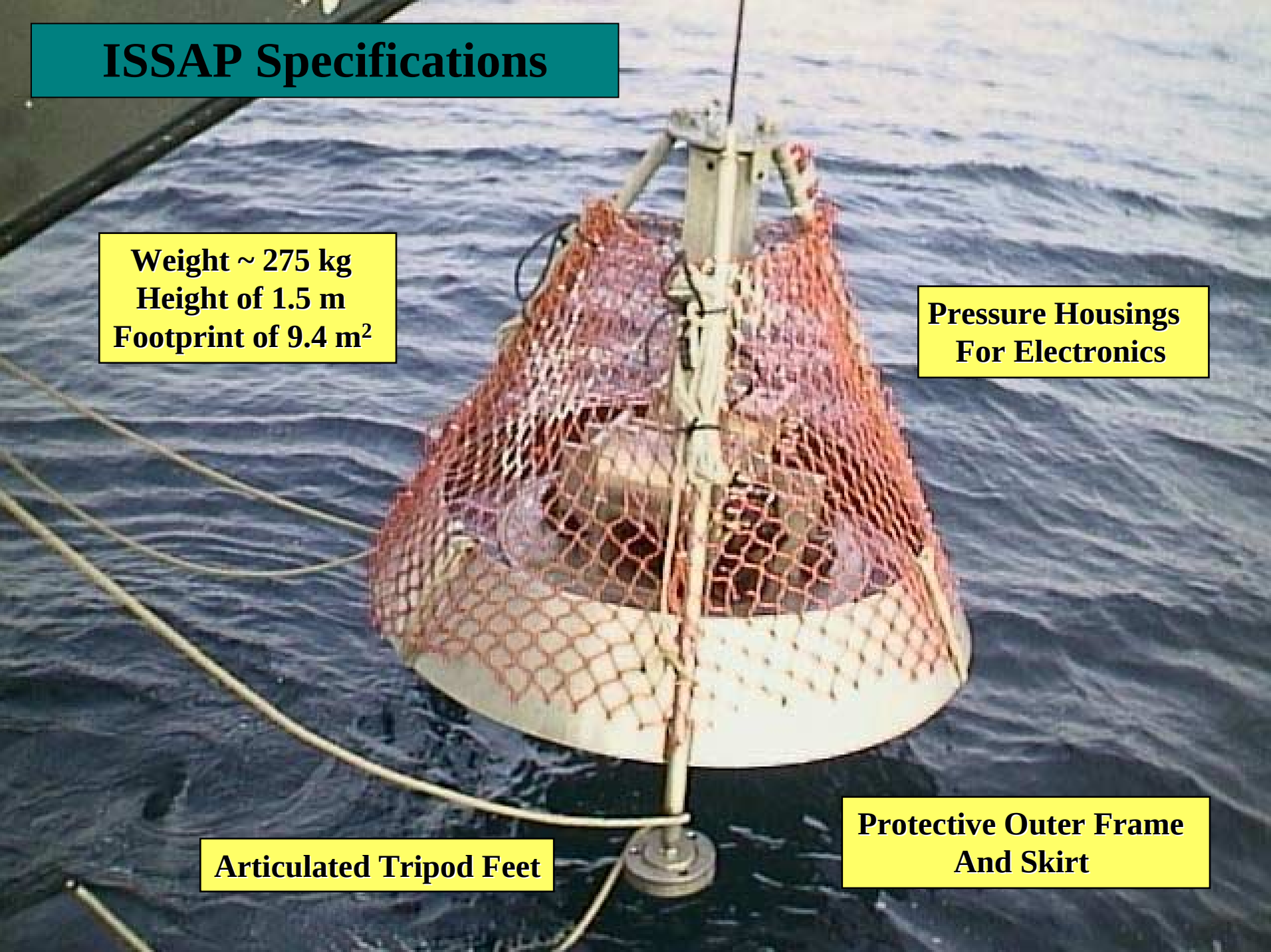
Mine Burial Station Locations



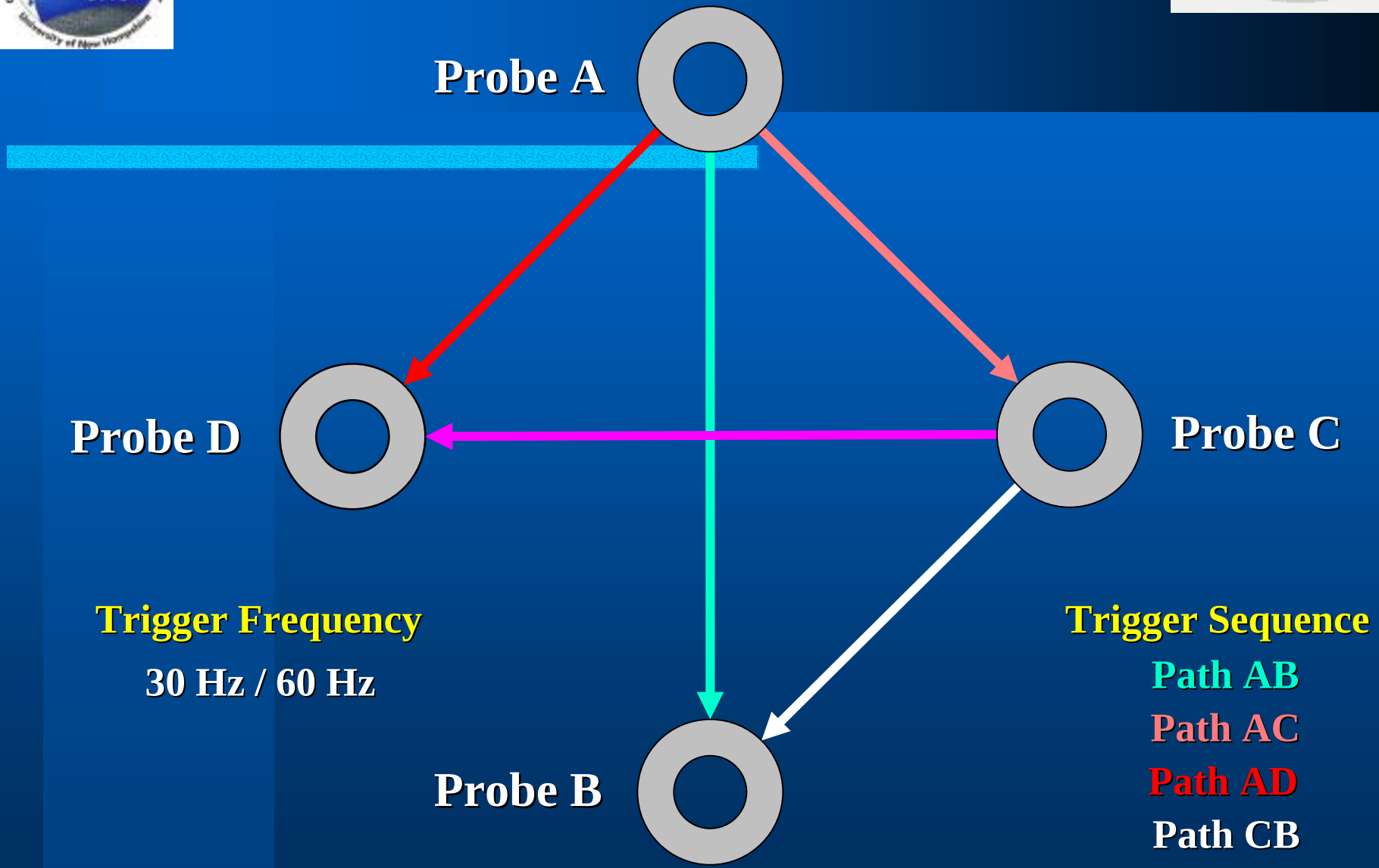
Underside View of ISSAP Probe



ISSAP Specifications



Probe Layout



Trigger Frequency

30 Hz / 60 Hz

Trigger Sequence

Path AB
Path AC
Path AD
Path CB
Path CD

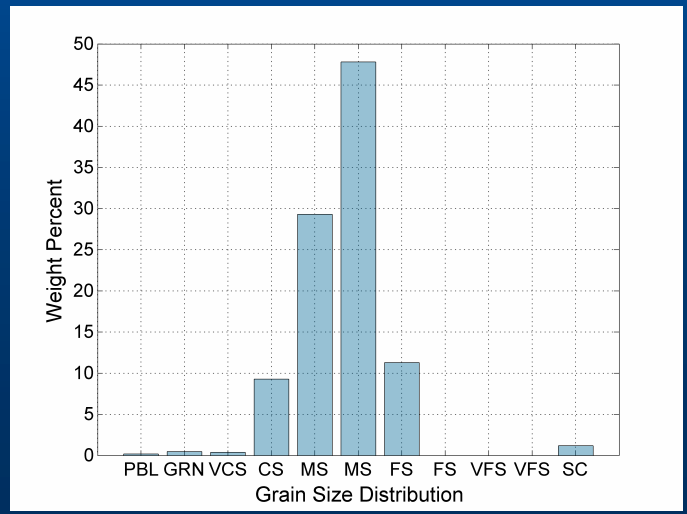
All Seawater Stations

	NJ	MV
Minimum Vp =	1493.9 m/s	1506.4 m/s
Maximum Vp =	1508.6 m/s	1524.7 m/s
Average Vp =	1500.8 m/s	1517.6 m/s
Stan. Dev. =	1.1 m/s	0.7 m/s

NJ Sediment Station (Medium Sand)

Minimum Vp =	1744.4 m/s
Maximum Vp =	1757.3 m/s
Average Vp =	1751.3 m/s
Stan. Dev. =	2.2 m/s

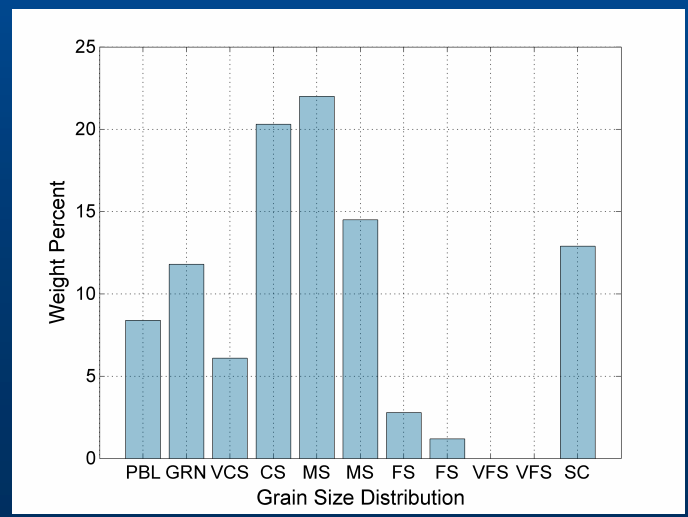
Path AB =	0.9 m/s
Path AC =	0.6 m/s
Path AD =	1.2 m/s
Path CB =	0.9 m/s
Path CD =	0.4 m/s



NJ Sediment Station

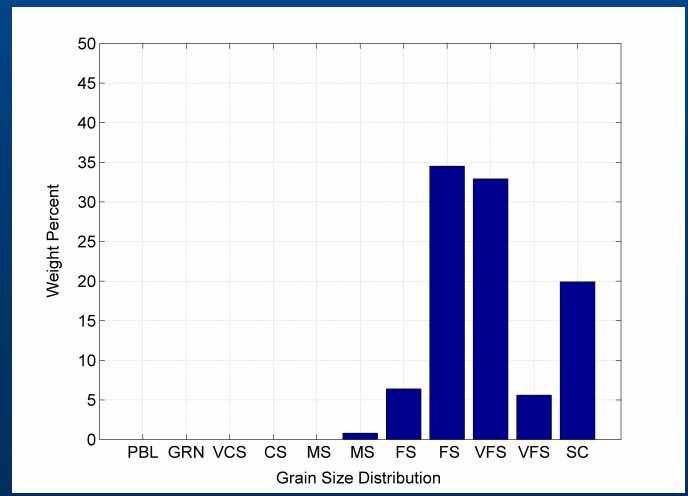
Minimum Vp =	1716.5 m/s
Maximum Vp =	1767.6 m/s
Average Vp =	1740.3 m/s
Stan. Dev. =	13.7 m/s

Path AB =	0.6 m/s
Path AC =	0.9 m/s
Path AD =	1.3 m/s
Path CB =	0.6 m/s
Path CD =	0.6 m/s



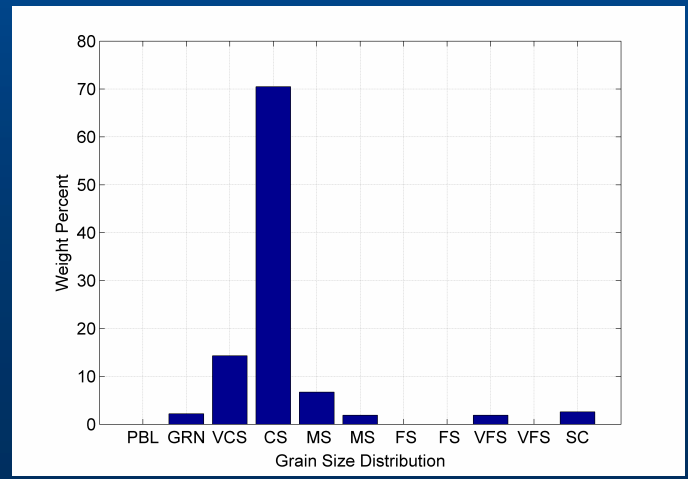
MV Sediment Station (Silty Fine Sand)

Minimum Vp =	1646.7 m/s
Maximum Vp =	1662.3 m/s
Average Vp =	1653.8 m/s
Stan. Dev. =	5.2 m/s
Path AB =	1.2 m/s
Path AC =	1.3 m/s
Path AD =	0.7 m/s
Path CB =	1.9 m/s
Path CD =	0.4 m/s



MV Sediment Station (Coarse Sand)

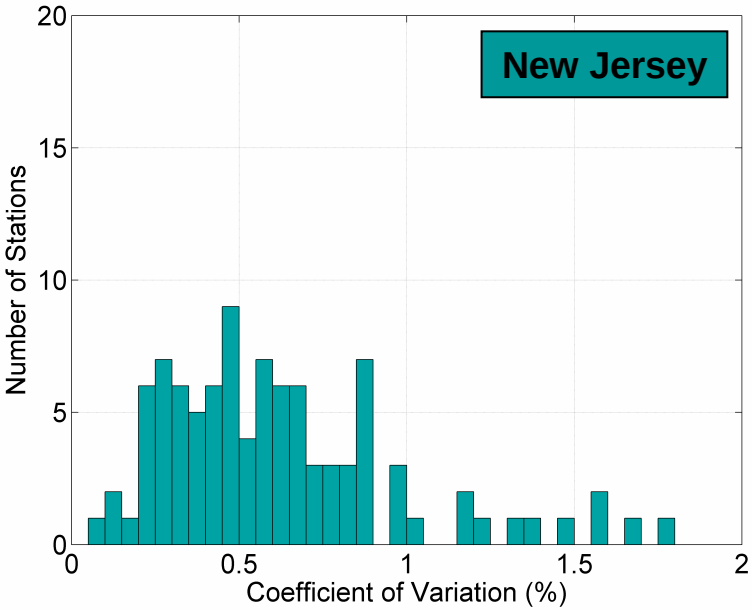
Minimum Vp =	1776.7 m/s
Maximum Vp =	1787.3 m/s
Average Vp =	1783.2 m/s
Stan. Dev. =	3.5 m/s
Path AB =	0.2 m/s
Path AC =	0.4 m/s
Path AD =	0.2 m/s
Path CB =	0.4 m/s
Path CD =	0.3 m/s

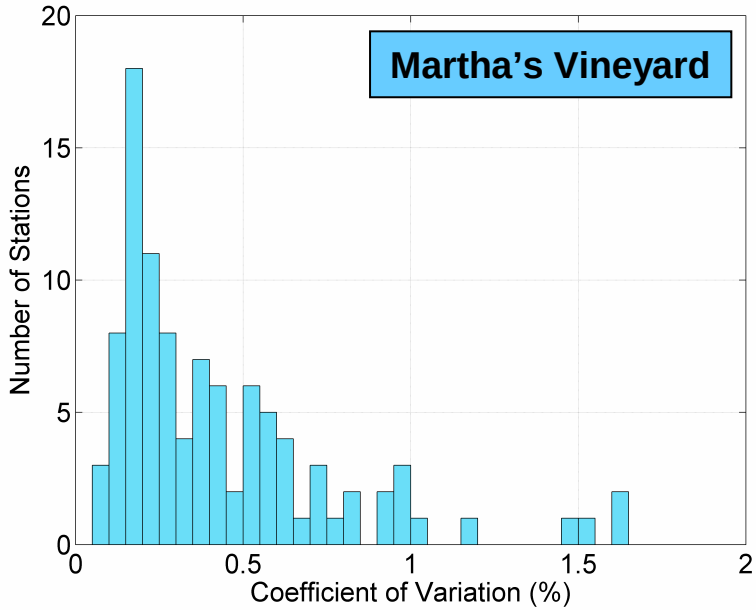


All Sediment Stations

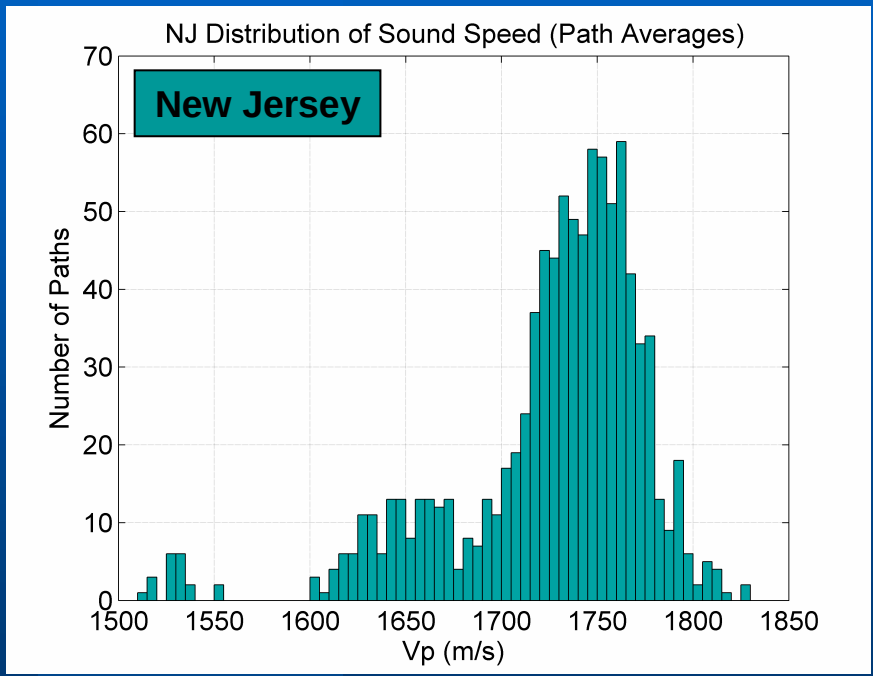
	NJ	MV
Minimum Vp =	1524.4 m/s	1574.8 m/s
Maximum Vp =	1801.4 m/s	1805.8 m/s
Average Vp =	1726.6 m/s	1741.3 m/s
Stan. Dev. =	12.0 m/s	9.7 m/s

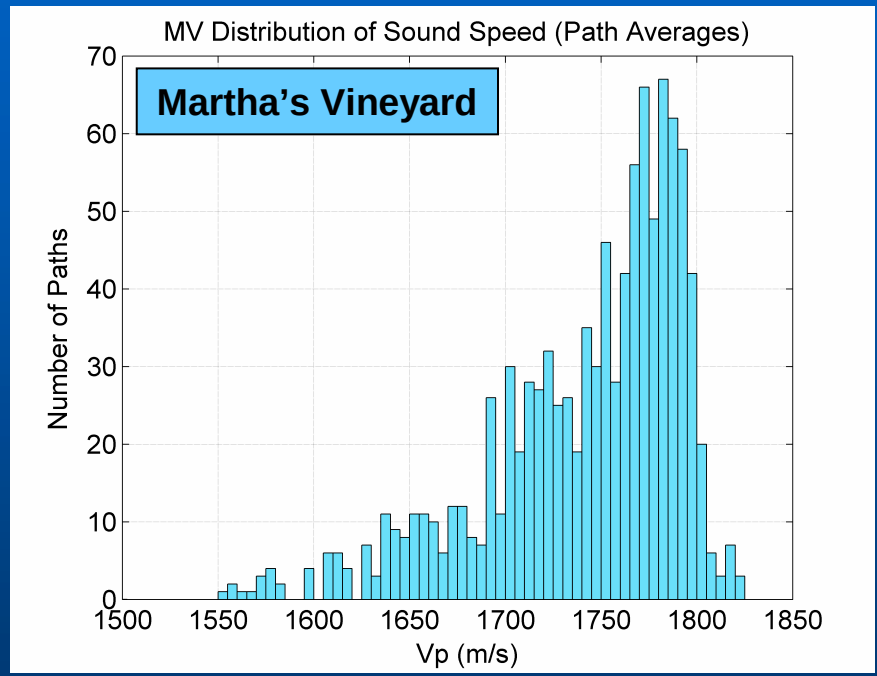
Sound Speed Variability



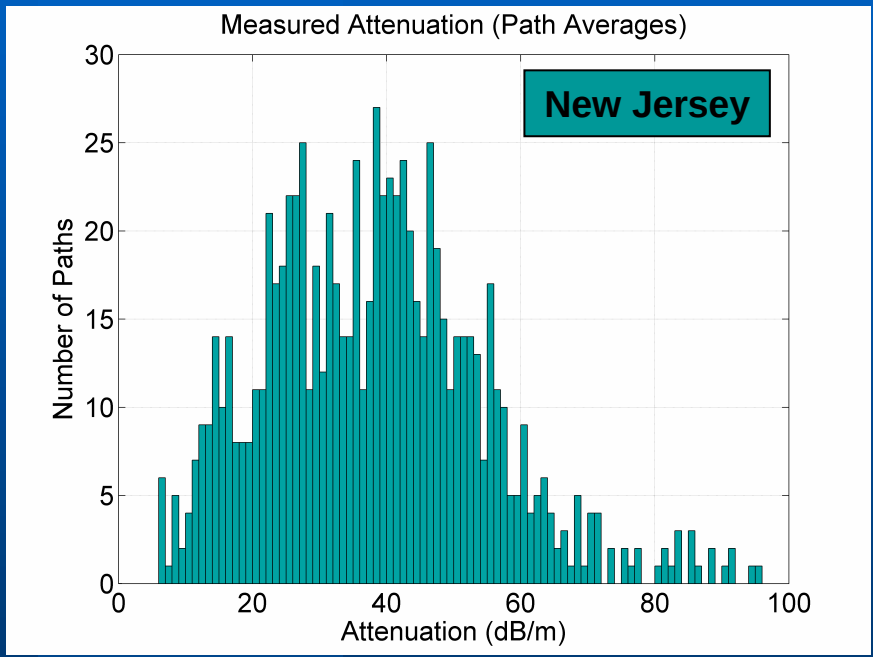


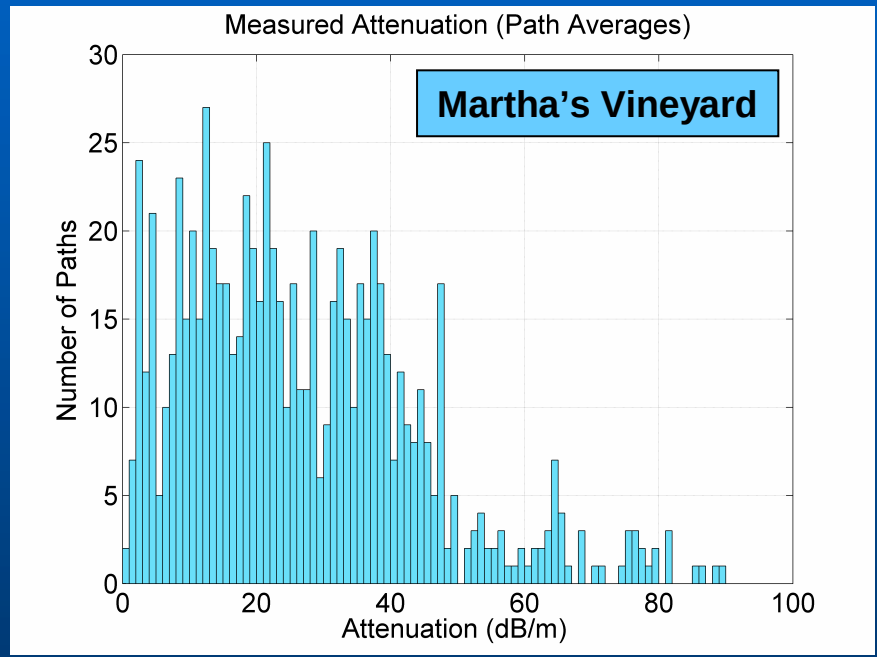
Sound Speed Variability

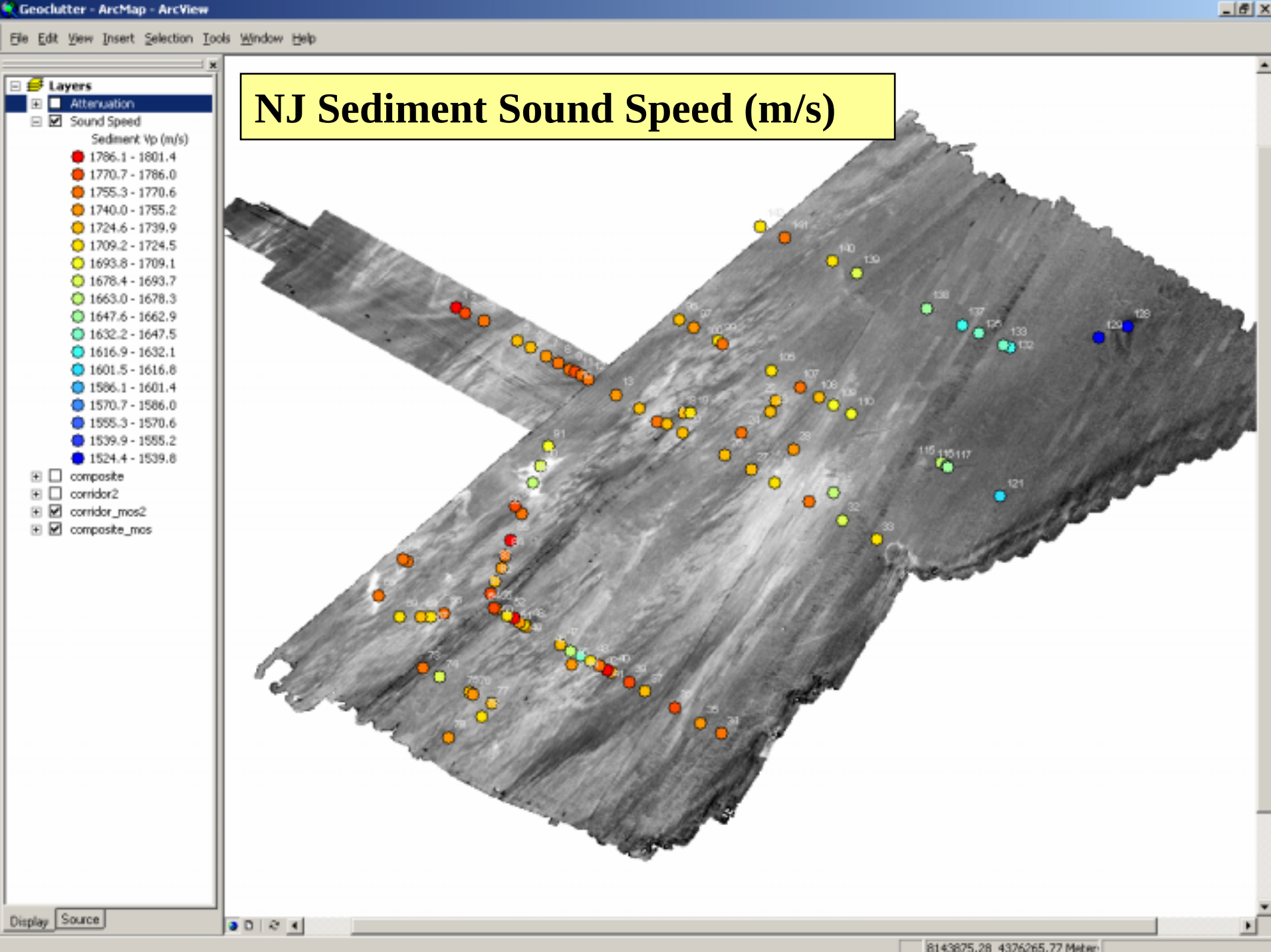


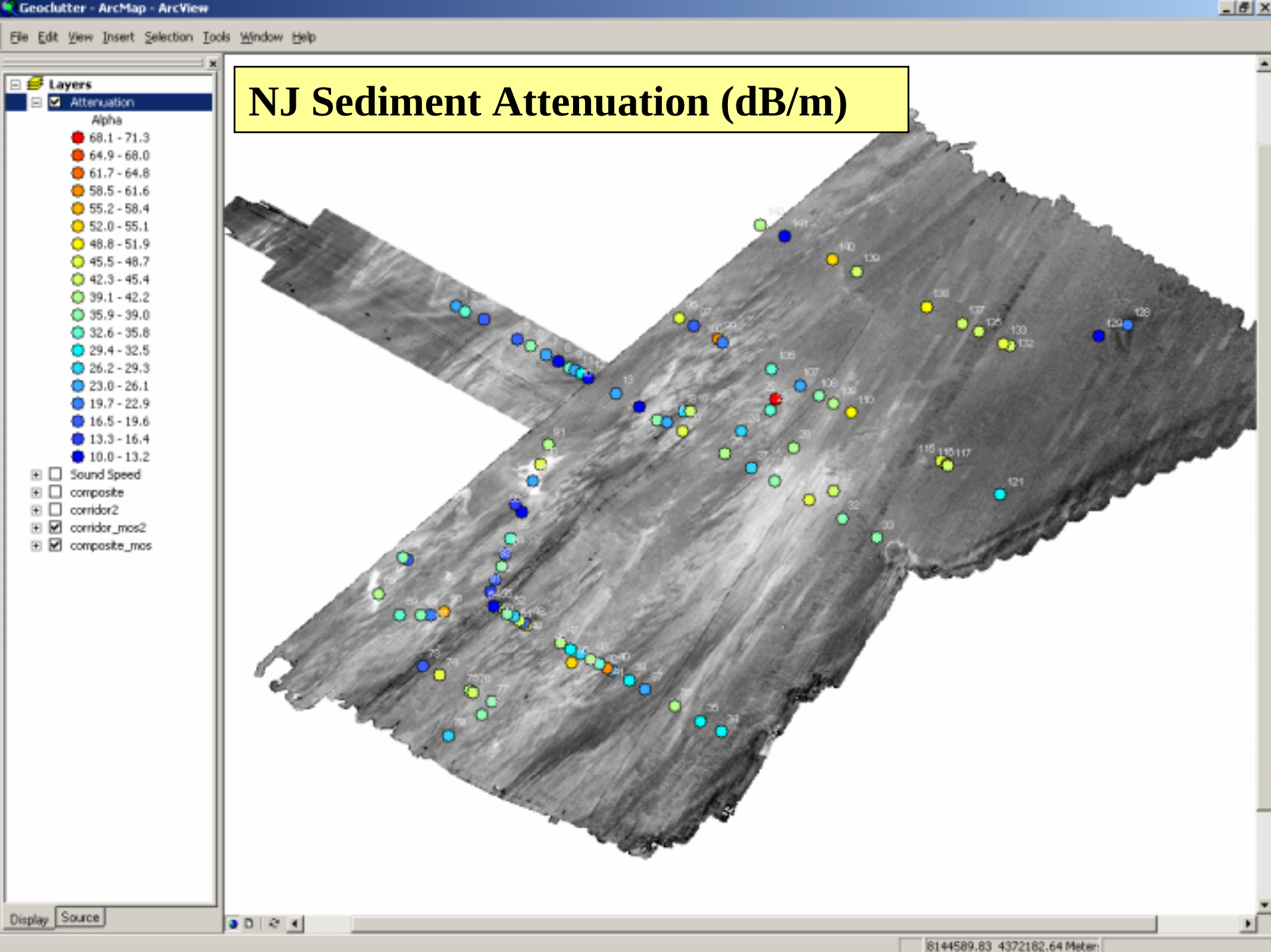


Attenuation Variability

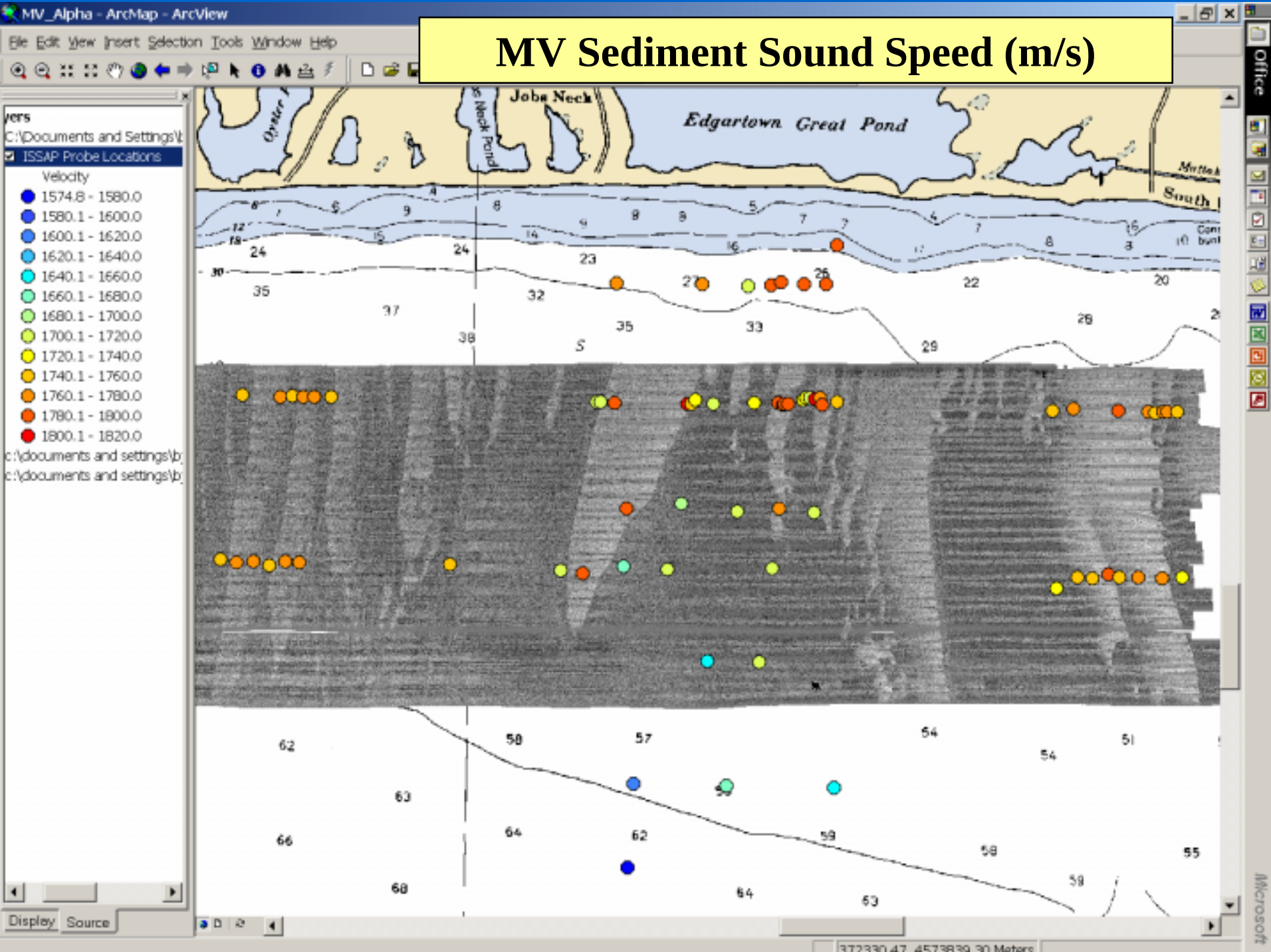




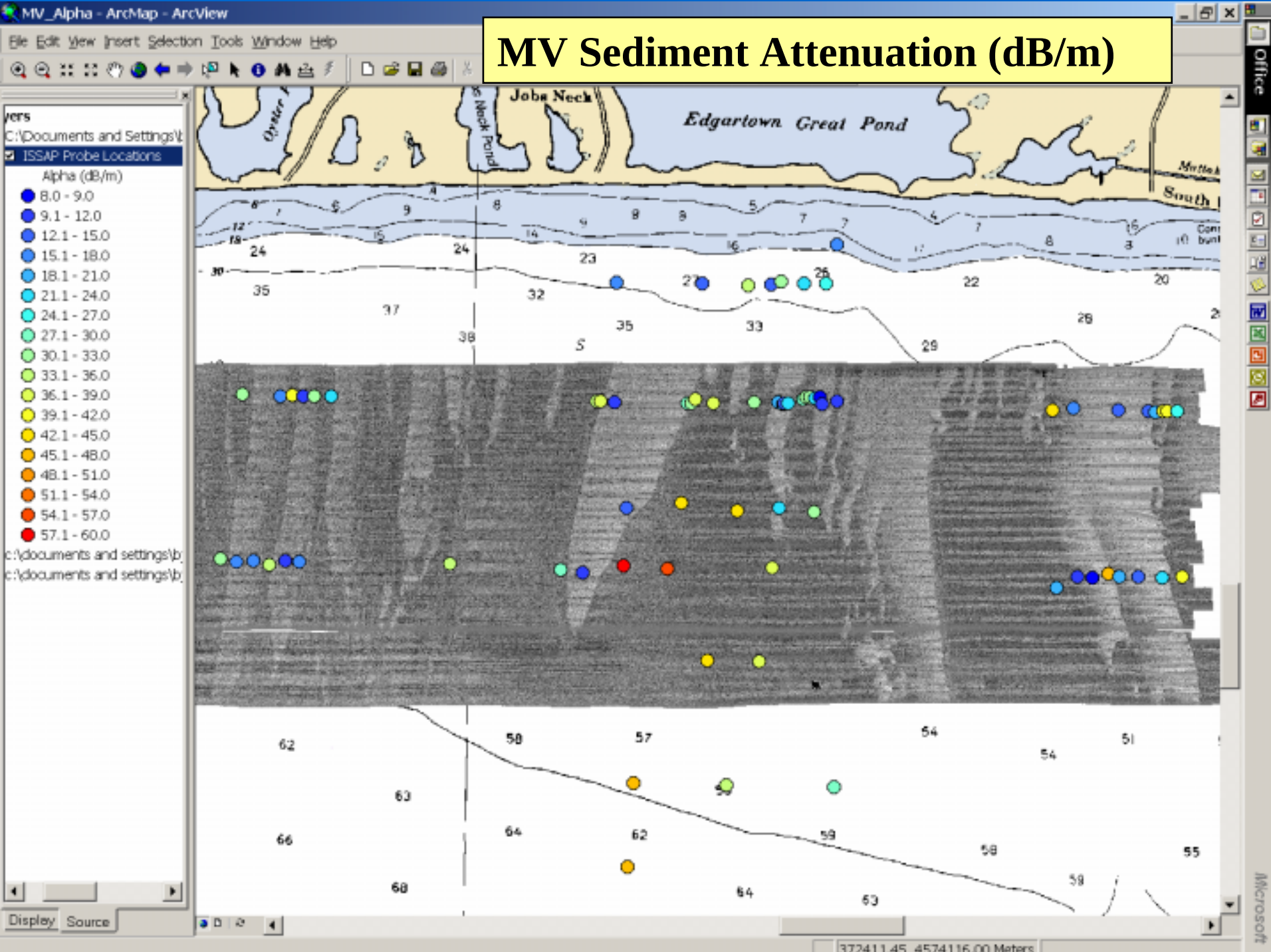

Geoclutter - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
Layers
Attenuation
Sound Speed
Sediment Vp (m/s)
1786.1 - 1801.4
1770.7 - 1786.0
1755.3 - 1770.6
1740.0 - 1755.2
1724.6 - 1739.9
1709.2 - 1724.5
1693.8 - 1709.1
1678.4 - 1693.7
1663.0 - 1678.3
1647.6 - 1662.9
1632.2 - 1647.5
1616.9 - 1632.1
1601.5 - 1616.8
1586.1 - 1601.4
1570.7 - 1586.0
1555.3 - 1570.6
1539.9 - 1555.2
1524.4 - 1539.8
composite
corridor2
corridor_mos2
composite_mos
Display
Source
NJ Sediment Sound Speed (m/s)


Geoclutter - ArcMap - ArcView
File Edit View Insert Selection Tools Window Help
Layers
Attenuation
Alpha
68.1 - 71.3
64.9 - 68.0
61.7 - 64.8
58.5 - 61.6
55.2 - 58.4
52.0 - 55.1
48.8 - 51.9
45.5 - 48.7
42.3 - 45.4
39.1 - 42.2
35.9 - 39.0
32.6 - 35.8
29.4 - 32.5
26.2 - 29.3
23.0 - 26.1
19.7 - 22.9
16.5 - 19.6
13.3 - 16.4
10.0 - 13.2
Sound Speed
composite
corridor2
corridor_mos2
composite_mos
Display
Source
NJ Sediment Attenuation (dB/m)
8144589.83 4372182.64 Meter

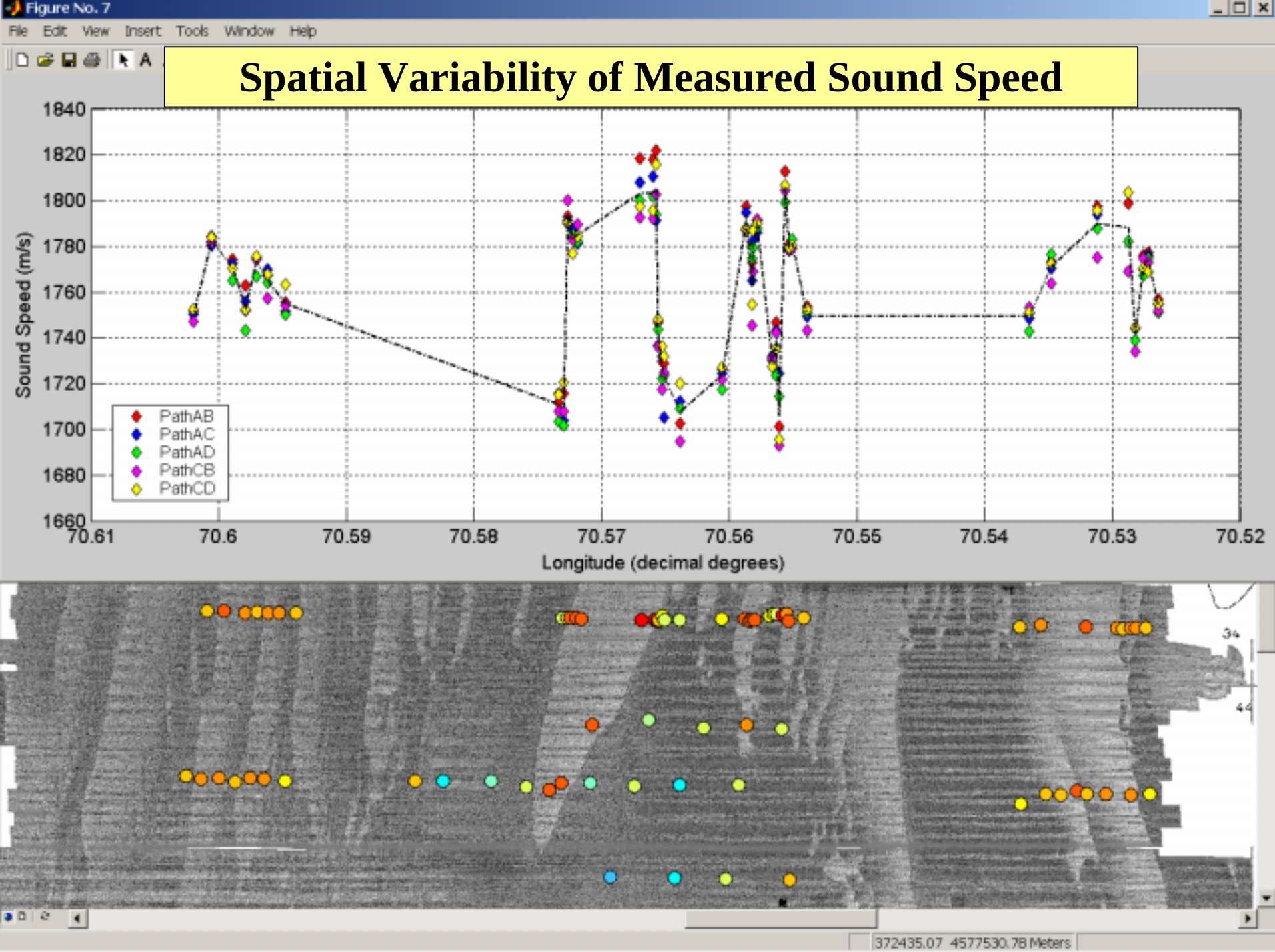
MV Sediment Sound Speed (m/s)



MV Sediment Attenuation (dB/m)



Spatial Variability of Measured Sound Speed



Conclusions

- ISSAP was successfully deployed on NJ shelf and and MVCO where nearly 120,000 acoustic measurements were made.
  - Measurement accuracy:
    +/- 0.5 to 1 m/sec for sound speed
    +/- 1 dB/m for attenuation
  - Sound speed range: 1524 – 1801 m/s (NJ)
    1575 – 1806 m/sec (MV)
  - Attenuation range : 6.5 - 59.3 dB/m @ 65 kHz (NJ)